

## Progress Report

Title of the project: Magnitude and extension of copper pollution effects on benthic faunal communities in San Diego Bay

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Progress report on activity September 17, 2008 - May 5, 2009

### Summary of the whole activity

#### Main results

During this period our efforts were focused on processing and analyzing of samples of sediment and water collected from three marinas during early June 2008. We determined the actual copper levels in sediment, over a range of exposure to boat hulls and distance from the mouth entrance of American's Cup (AC, also known as Commercial Basin), Harbor Island West (HW), and Harbor Island East (HE). Based on these results we generated preliminary probability models of Cu distribution for each one of the three marinas. These maps enabled us to identify hot spots of Cu concentrations that exceed the Effect Range Medium (i.e. over 270 mg Cu/kg) (Fig. 1A, B, C). Indeed, in AC and HW, two sites each had Cu concentrations over 400 mg/kg. In HW and HE, the Cu levels exhibit a clear gradient, with highest concentrations found beneath the moored boats. On average, Cu in sediment was highest in AC (209 mg/kg) followed by HW (158 mg/kg) and HE (121 mg/kg).

Concurrently, we measured ion  $\text{Cu}^{++}$  activity (as pCu) in three water vertical zones (surface, bottom and pore water). The free ion  $\text{Cu}^{++}$  has been suggested to be a better predictor of the potential Cu bioavailability and potential toxicity than total dissolved copper. The pCu unit is a measure of the activity of the Cu(II) ion and is defined as the negative log of the  $\text{Cu}^{++}$  ion concentration ( $\text{pCu} = -\log_{10} [\text{Cu}^{++}]$ ). We found a depth-related gradient in  $\text{Cu}^{++}$  activity, with higher  $\text{Cu}^{++}$  concentrations (i.e. lower pCu) in the surface water than in pore water. This suggests that the source of Cu is at the surface (i.e. boat hulls) and that sediment is a source of organic ligands that bind Cu, making it less bioavailable. In addition, we assessed the Cu complexation capacity at selected sites of the three basins and determined particulate Cu concentrations in suspended particulate matter in order to estimate the percent contribution of particulate Cu bioavailable to the total Cu pool.

Assessments were made of basins sediment properties. For each station we determined total organic matter, sand and mud content, chlorophyll *a* and phaeopigment concentrations. Sediment redox potential was measured on fresh, undisturbed sediment samples.

Macrofauna. All sediment samples collected for analysis of macrofaunal community structure were processed. Infauna were identified to the lowest taxon possible (usually species) and counted to determine densities and biomass. Univariate and multivariate community analyses are underway and assemblage relationship to Cu distributions are underway.

#### **For each activity line:**

Activity carried out:

- Field: exploratory sample collection in Harbor Island (west and east) and American's Cup Basin (Commercial Basin) already done.

Laboratory: Dissolved copper: pending

desk: Literature search to obtain historical records. Probability models of sediment Cu distribution. Available data being analyzed and integrated.

Table of activity - percentage carried out

Activity	Field	Laboratory	Desk
	Previous/this period	Previous/this period	Previous/this period
Exploratory	%100 / 100%	%50 / 80%	%20 / 50%

Activity in progress:

- field: preparation for a sampling late May/early June 2009 intended to collect invertebrates at selected sites (e.g. Cu "hot spots" vs low Cu) to determine Cu in tissue.
- laboratory: Dissolved Cu pending
- desk : search and revision of literature, data analyses

**Deliverables**

Report produced

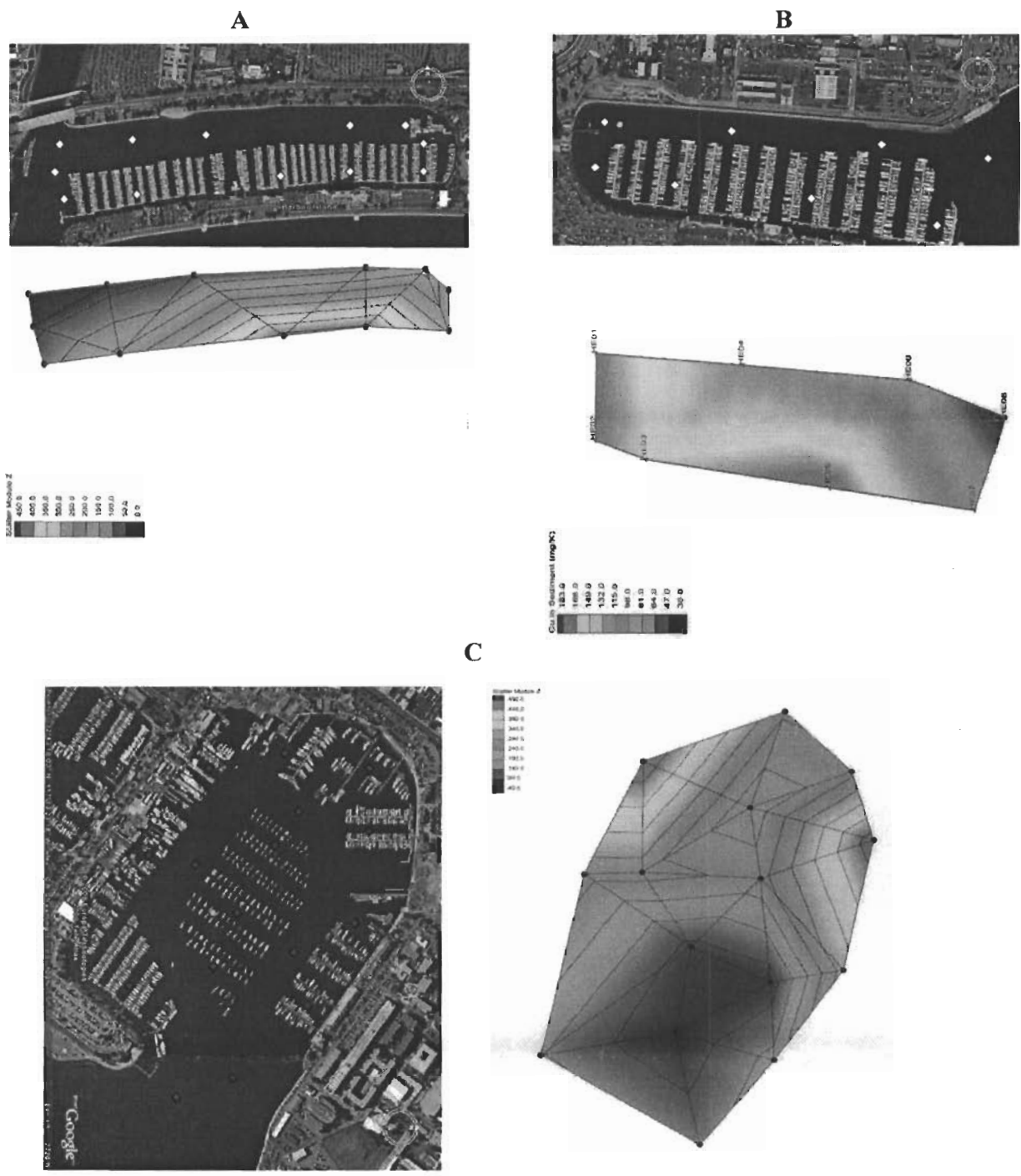


Fig. 1. Preliminary probability models of sediment Cu distribution in (A) Harbor Island West, (B) Harbor Island East, and (C) American's Cup.